Transistor Configuration:-

- Transistor में तीन terminals रहते हैं.
- Emitter base और Collector terminals.
- जब Transistor को circuit में जोड़ा जाता है तो चार terminals की जरूरत पड़ती है.
- दो input terminals के रूप में और दो output terminals के रूप में.
- इसी लिए किसी एक terminal को input और output में common रखना रखा जाता है.

- **इस तरह Transistor के तीन प्रकार से connections संभव है.**

1). Common Base Connection.

या

Common, Base Configuration. (CB).

2). Common Emitter Connection.

या

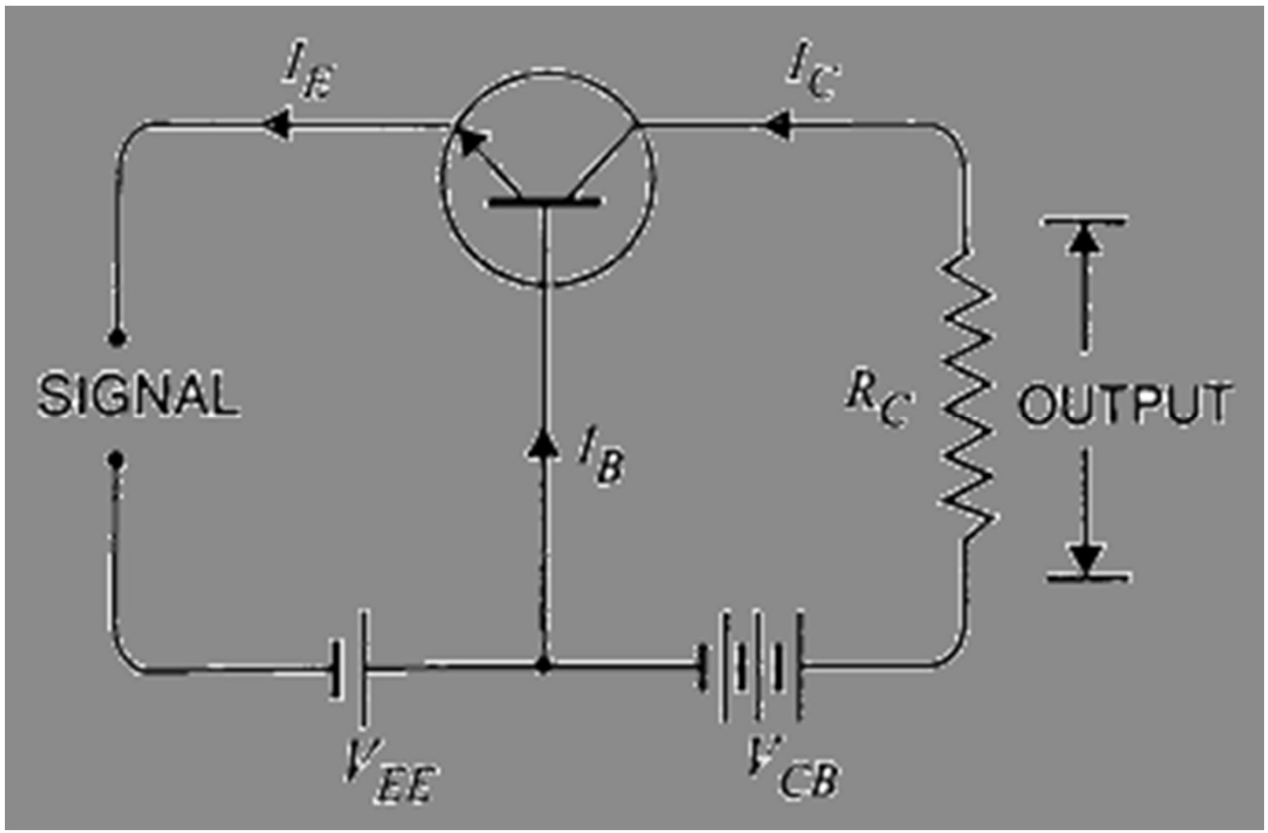
Common Emitter Configuration. (CE).

3). Common Collector Connection.

या

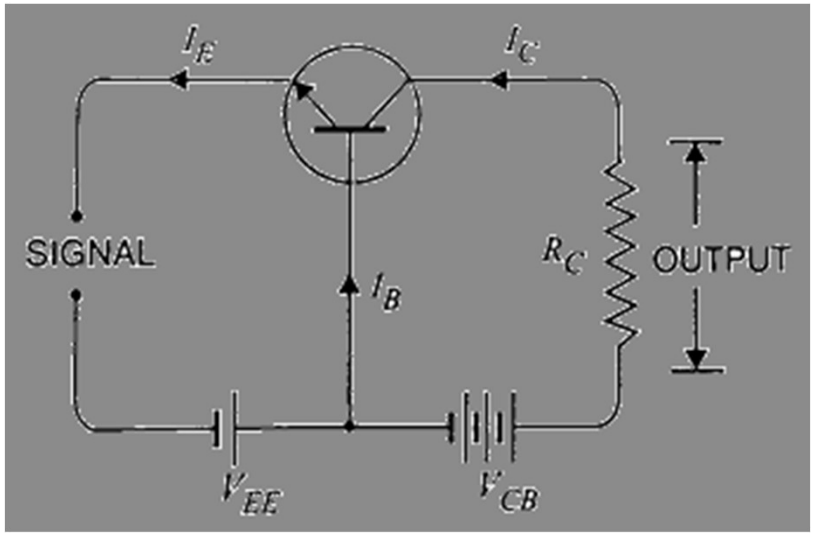
Common Collector Configuration. (CC).

Common Base Connection. या Common Base Configuration. (CB).



Common Base Connection. या

Common Base Configuration. (CB).

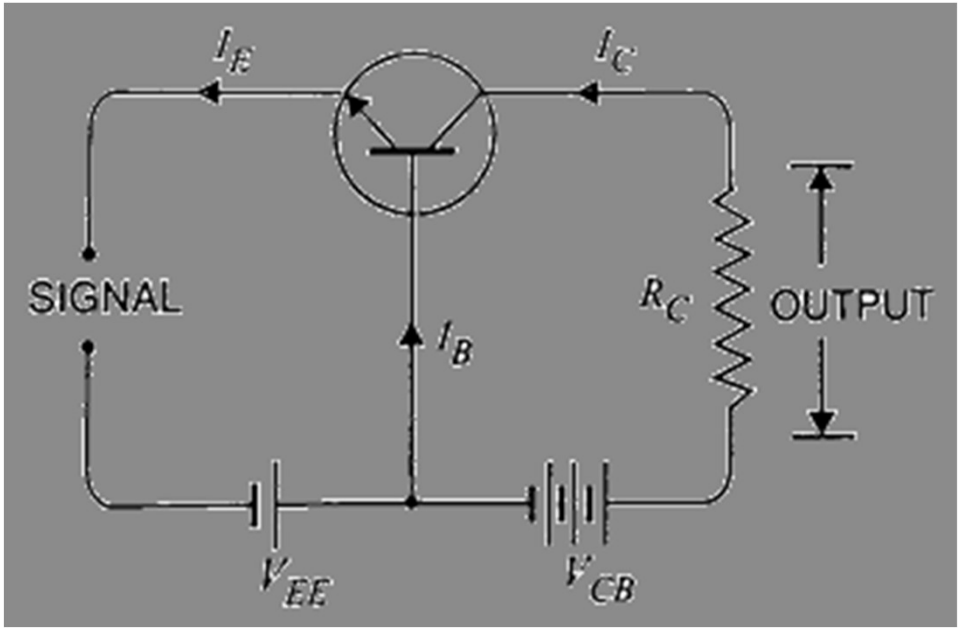


Common Base Connection में input को base और Emitter के मध्य में apply किया जाता है

और output, Collector तथा base के मध्य में प्राप्त किया जाता है,

इस तरह input circuit और output circuit के मध्य base common रहता है.

Common Base Connection.



I_E = Emitter current.

I_B = base current

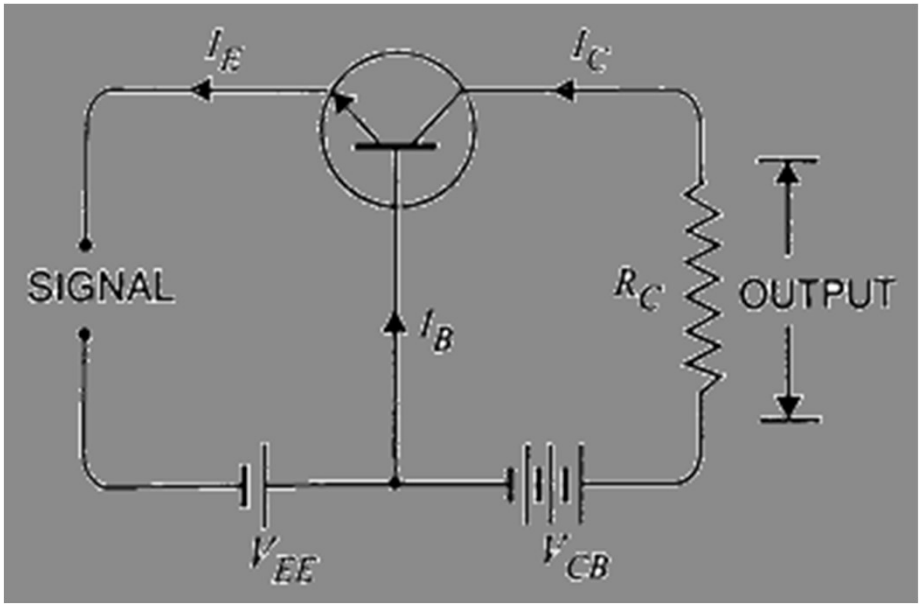
I_C = Collector current

α = Current amplification factor in common base Connection.

V_{EE} = Emitter base junction को forward bias रखने के लिए apply किया गया voltage.

V_{CB} = Collector base junction को reverse bias रखने के लिए apply किया गया voltage.

Common Base Connection.



Common Base Connection में V_{CB} को constant रखते हुए

Collector current के बदलाव (ΔI_C)

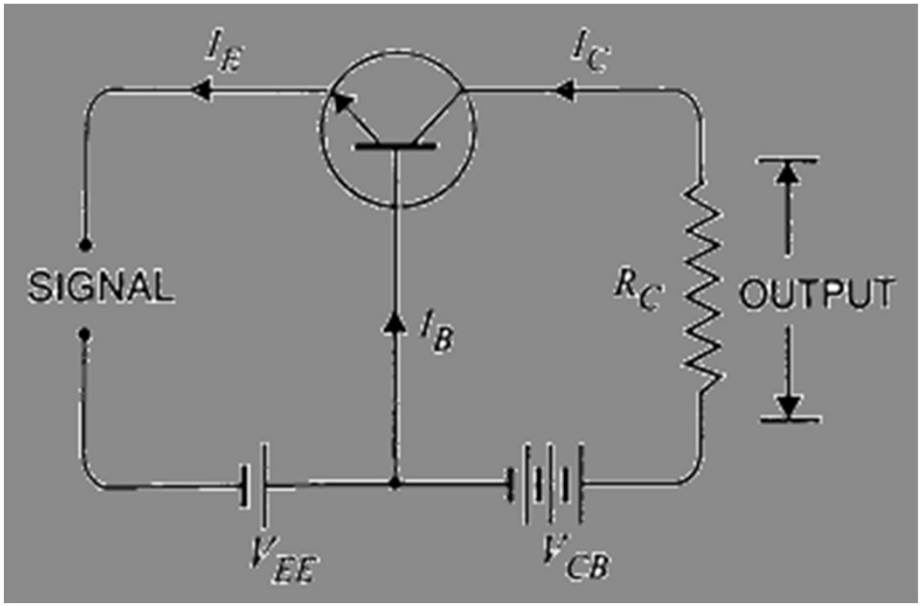
और

Emitter current के बदलाव (ΔI_E)

के अनुपात को

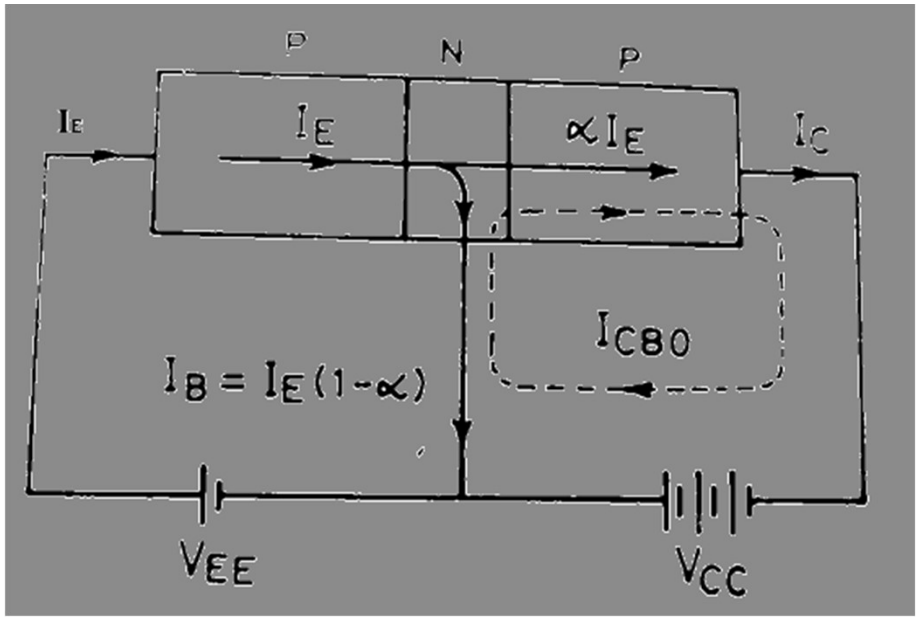
Current amplification factor (α) कहते हैं

Common Base Connection.



$$\alpha = -\frac{\Delta I_C}{\Delta I_E}$$ at Constant V_{CB} .

Negative sign यह दर्शाता है की I_C current, transistor के अन्दर और I_E current, transistor के बहार flow होता है.



Total Collector current

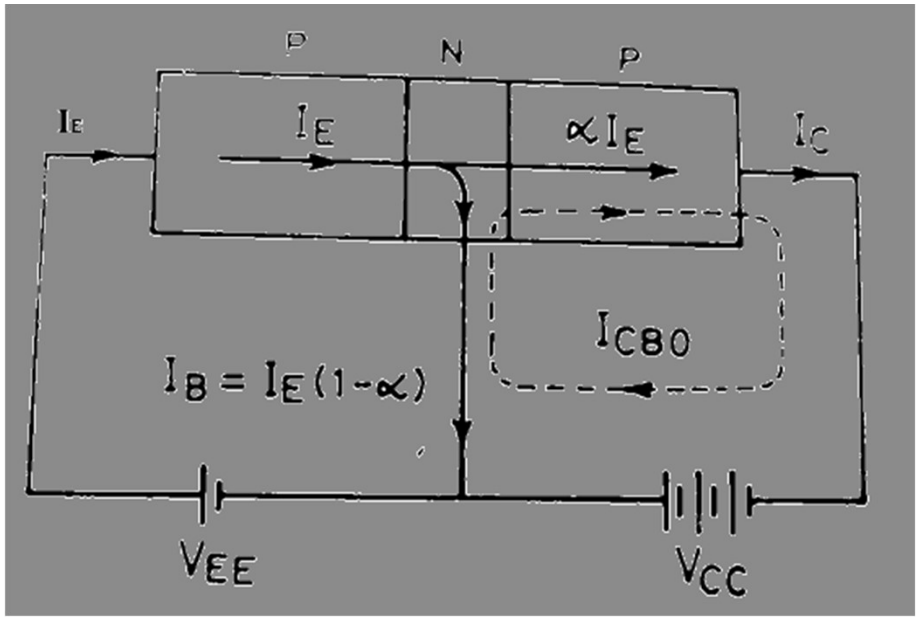
$\alpha = -\frac{\Delta I_C}{\Delta I_E}$ ------- $eq\ no\ (1)$ For AC Signals

$\alpha = -\frac{I_C}{I_E}$ ------- $eq\ no\ (2)$ For DC Signals

$I_C = \alpha\, I_E$ ------- $eq\ no\ (3)$

Total Collector current

$$I_C = \alpha I_E + I_{CBO} \qquad \text{-------} \quad eq\ no\ (1)$$



αI_E = Emitter current का वह component जो collector current बना है, यह current majority carriers के कारण होता है.

I_{CBO} = यह leakage current ($I_{Leakage}$) होता है, Collector base Junction, reverse bias होने के कारण minority carriers flow होते है.

Total Collector current

$$I_C = \alpha I_E + I_{CBO} \quad ------ \quad eq\ no\ (1)$$

$$I_C = \alpha(I_C + I_B) + I_{CBO} \quad ------ \quad eq\ no\ (2)$$ we know that $I_E = I_C + I_B$

$$I_C = \alpha I_C + \alpha I_B + I_{CBO}$$

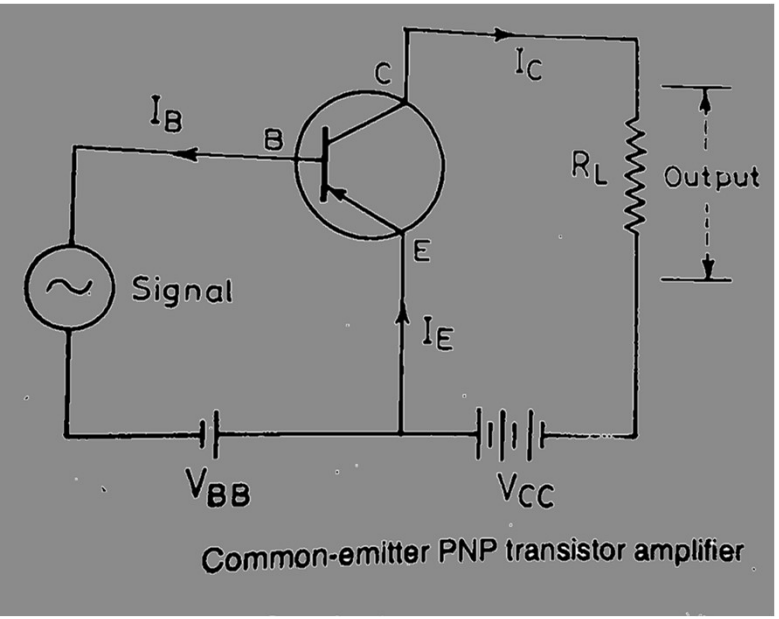
$$I_C - \alpha I_C = \alpha I_B + I_{CBO}$$

$$I_C(1 - \alpha) = \alpha I_B + I_{CBO}$$

$$I_C = \frac{1}{(1-\alpha)} \alpha I_B + \frac{1}{(1-\alpha)} I_{CBO}$$

$$I_C = \left(\frac{\alpha}{1-\alpha}\right) I_B + \frac{1}{(1-\alpha)} I_{CBO}$$

Common Emitter Connection. या Common Emitter Configuration. (CE).



Common-emitter PNP transistor amplifier

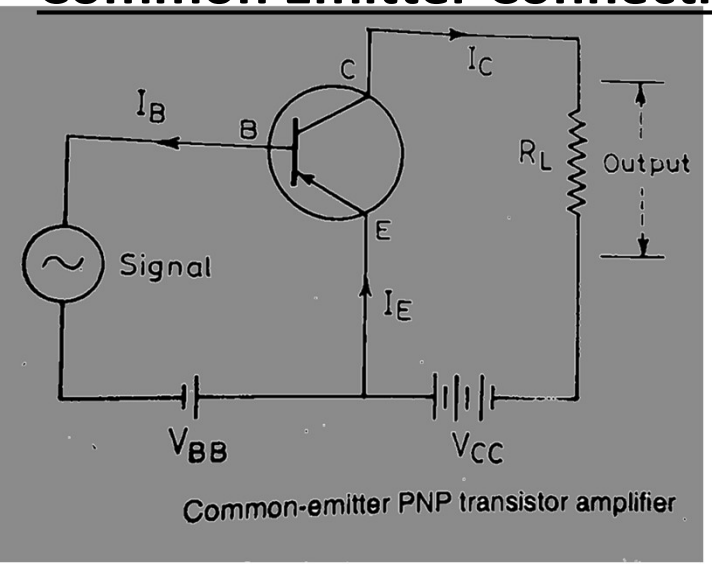
Common Emitter Connection में base और Emitter के मध्य में input लगाया जाता है,

Emitter और collector के मध्य में output प्राप्त किया जाता है

चुकी Emitter और input circuit और output circuit में common है.

इसी लिए इस Connection को Common Emitter Connection कहते हैं.

Common Emitter Connection. या Common Emitter Configuration. (CE).



Common-emitter PNP transistor amplifier

Current Amplification Factor (β):-

Collector current के बदलाव (ΔI_C) और base current के बदलाव (ΔI_B) के अनुपात को Current amplification factor (β) कहते हैं

$$\beta = \frac{\Delta I_C}{\Delta I_B}$$

Relation Between α and β

$$\alpha = \frac{\Delta I_C}{\Delta I_E} \quad ------ \quad eq\ no\ (1)$$

$$\beta = \frac{\Delta I_C}{\Delta I_B} \quad ------ \quad eq\ no\ (2)$$

$$I_E = I_C + I_B \quad ------ \quad eq\ no\ (3)$$

$$\Delta I_E = \Delta I_C + \Delta I_B$$

$$\Delta I_B = \Delta I_E - \Delta I_C \quad ----- \quad eq\ no\ (4)$$

Substituting the value of ΔI_B in $eq\ no\ (2)$

$$\beta = \frac{\Delta I_C}{\Delta I_E - \Delta I_C} \quad ------ \quad eq\ no\ (5)$$

Dividing the numerator and denominator of R.H.S of $eq\ no\ (5)$ by ΔI_E,

We get

$$\beta = \frac{\frac{\Delta I_C}{\Delta I_E}}{\frac{\Delta I_E}{\Delta I_E} - \frac{\Delta I_C}{\Delta I_E}}$$

$$\beta = \frac{\frac{\Delta I_C}{\Delta I_E}}{1 - \frac{\Delta I_C}{\Delta I_E}}$$

$$\beta = \frac{\alpha}{1-\alpha} \qquad \because \quad \alpha = \frac{\Delta I_C}{\Delta I_E}$$

Relation Between α and β

$$\beta = \frac{\alpha}{1-\alpha} \text{ ------ } eq\ no\ (5)$$

Cross Multiplying eq. no- (5), we get

$$\beta(1-\alpha) = \alpha$$

$$\beta - \alpha\beta = \alpha$$

$$\beta = \alpha + \alpha\beta$$

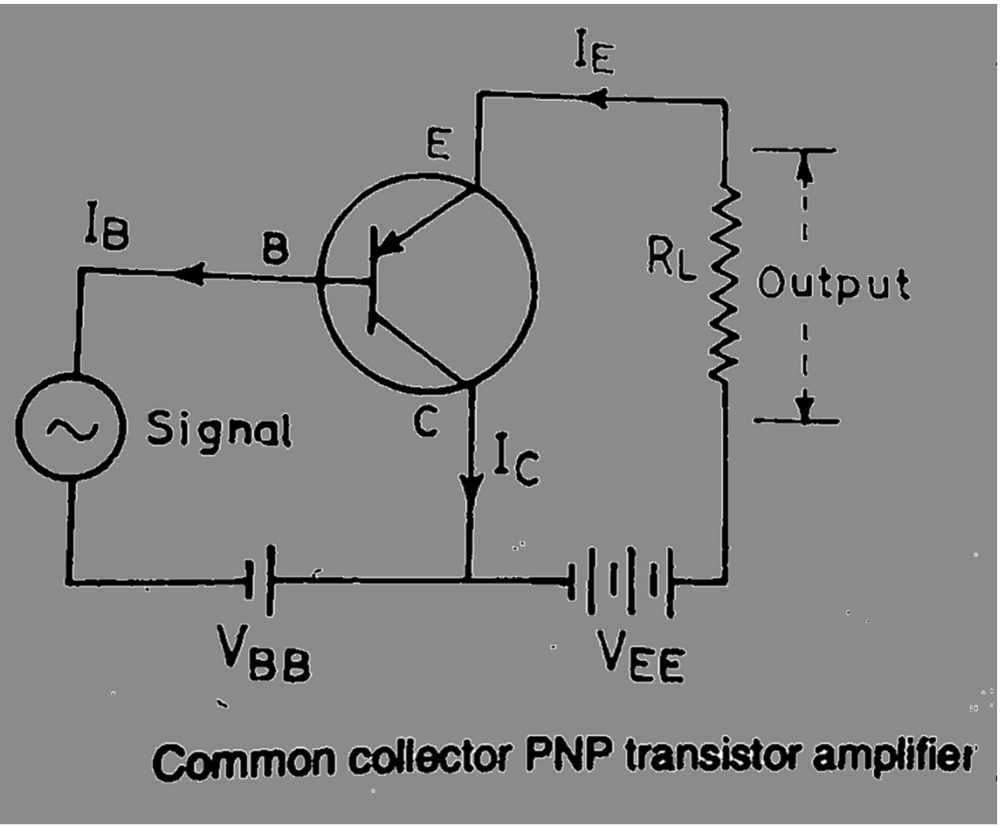
$$\beta = \alpha(1+\beta)$$

$$\alpha = \frac{\beta}{1+\beta}$$

$$\beta = \frac{\alpha}{1-\alpha}$$

$$\alpha = \frac{\beta}{1+\beta}$$

Common Collector Connection. या Common Collector Configuration. (CC).



Common collector PNP transistor amplifier

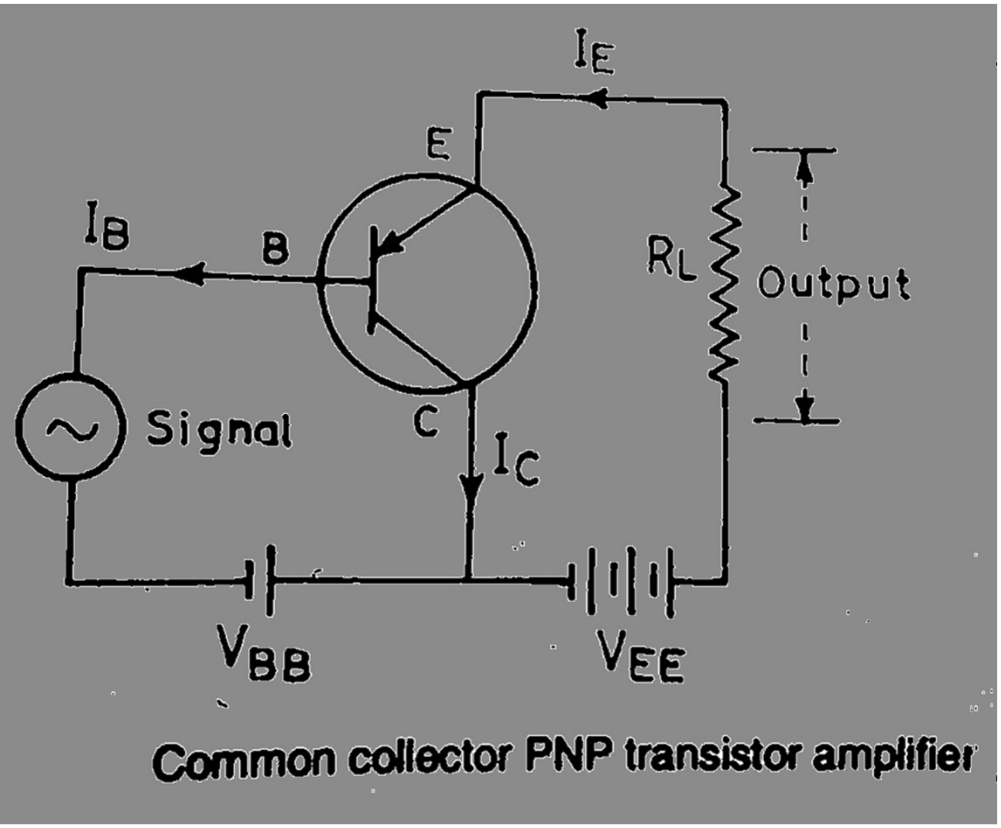
Common Collector Connection में base और Collector के मध्य में input लगाया जाता है,

Emitter और collector के मध्य में output प्राप्त किया जाता है,

चुकी Collector और input circuit और output circuit में common है.

इसी लिए इस Connection को Common Collector Connection कहते हैं.

Common Collector Connection. या Common Collector Configuration. (CC).



Common collector PNP transistor amplifier

Current Amplification Factor (γ):-

Emitter current के बदलाव (ΔIE) और

base current के बदलाव (ΔIB) के

अनुपात को Current amplification factor (γ) कहते हैं

$$\gamma = \frac{\Delta I_E}{\Delta I_B}$$

Relation Between α and γ

$$\alpha = \frac{\Delta I_C}{\Delta I_E} \quad ------ \quad eq\ no\ (1)$$

$$\gamma = \frac{\Delta I_E}{\Delta I_B} \quad ------ \quad eq\ no\ (2)$$

$$I_E = I_C + I_B \quad ------ \quad eq\ no\ (3)$$

$$\Delta I_E = \Delta I_C + \Delta I_B$$

$$\Delta I_B = \Delta I_E - \Delta I_C \quad ------ \quad eq\ no\ (4)$$

Substituting the value of ΔI_B in $eq\ no\ (2)$

$$\gamma = \frac{\Delta I_E}{\Delta I_E - \Delta I_C} \quad ------ \quad eq\ no\ (5)$$

Dividing the numerator and denominator of R.H.S of $eq\ no\ (5)$ by ΔI_E,

We get

$$\gamma = \frac{\frac{\Delta I_E}{\Delta I_E}}{\frac{\Delta I_E}{\Delta I_E} - \frac{\Delta I_C}{\Delta I_E}}$$

$$\gamma = \frac{1}{1 - \frac{\Delta I_C}{\Delta I_E}}$$

$$\gamma = \frac{1}{1-\alpha} \qquad \alpha = \frac{\Delta I_C}{\Delta I_E}$$

Relation Between β and γ

$$\alpha = \frac{\beta}{1+\beta}$$

$$1-\alpha = 1-\frac{\beta}{1+\beta}$$

$$1-\alpha = \frac{1+\beta-\beta}{1+\beta}$$

$$1-\alpha = \frac{1}{1+\beta} \text{ ------ } eq\ no\ (1)$$

$$\gamma = \frac{1}{1-\alpha}$$

$$1-\alpha = \frac{1}{\gamma} \text{ ------ } eq\ no\ (2)$$

Comparing eq.no 1 & eq.no 2

$$\frac{1}{\gamma} = \frac{1}{1+\beta}$$

$$\gamma = 1+\beta$$

Relation Between α ,β and γ

$$\alpha = \frac{\beta}{1+\beta}$$

$$\beta = \frac{\alpha}{1-\alpha}$$

$$\gamma = \frac{1}{1-\alpha}$$

$$\gamma = 1 + \beta$$